

## **SPECIAL CONDITIONS OF TENDER**

**COMUNE DI TREVIGLIO (BG)**  
**Via dei Mulini n. 10/20 and via F. Filzi n. 11/13**  
**Building envelope and systems extraordinary maintenance**  
**for energy saving**

**CLIENT:** ALER di Bergamo-Lecco-Sondrio

February 2016

**COMUNE DI TREVIGLIO (BG)**  
**Via dei Mulini n. 10/20 and via F. Filzi n. 11/13**  
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## CONDITIONS

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## PREFACE

This tender, promoted by ALER Bergamo-Lecco-Sondrio and Regione Lombardia, is developed within the PROBIS European Project (Public Procurements of Building Innovative Solutions – *Appalti pubblici di soluzioni edilizie innovative*), co-funded by the European Commission (under the agreement n. GA 665252 and after the award of the call 65/G/ENT/CIP/13/N02C021).

The main purpose of the PROBIS European Project ([www.probis.eu](http://www.probis.eu)) is taking advantage of public demand to encourage and qualify the building sector, toward the development and the improvement of solutions, as well as integrated approaches for the buildings refurbishment. It can be done by coordination of four public procurement procedures for the energy efficiency upgrade of buildings placed in Torino and Treviglio (BG) in Italy, Borlange (Sweden) and Miskolc (Hungary).

This tender is also useful to check the replicable conditions, in different contexts, of the innovative solutions recommended by the Contracting Authority.

Regione Lombardia is interested in adding value to each innovative and replicable solution, within the annual Directive framework addressed to *Aziende Lombarde per l'edilizia Residenziale* (ALER), and in the funding programs implementation for the energy upgrading interventions, previously planned for the coming years.

**COMPREHENSION OF THE CONDITIONS AND ENCLOSED RELATED DOCUMENTS** (Legge 10 report, energy audit reports, technical reports, drawings, tables, etc.)

DESCRIPTION OF WORKS AND SUPPLIED COMPONENTS, WITHIN THE CURRENT CONDITIONS OF TENDER AND RELATED TECHNICAL DOCUMENTS, IS CONSIDERED AS:

- **MINIMUM PERFORMANCE REQUIREMENTS** OF THE SOLUTIONS OFFERED BY THE COMPETITORS;
- **REFERENCE FOR THE QUALITY AND QUANTITY LEVELS OF THE REQUIRED INTERVENTIONS.**

**IN COMPLIANCE WITH THE CURRENT PERFORMANCE BASED TENDER NOTICE, OFFERS ARE EFFECTIVE IF THEY FULLY MATCH THE Project realized by the Contracting Authority, OR THEY ARE AN IMPROVEMENT, EVEN IF PERTAINED TO TECHNOLOGICAL OPTIONS, DIFFERENT FROM THE ONES IN BILL OF QUANTITIES, AS LONG AS THE FOLLOWING CONDITIONS ARE ABIDE BY:**

- BE THE OVERALL INTERVENTION QUALITY LEVEL UNCHANGED OR IMPROVED, IN ALL ITS PARTS, EVEN THOSE ARE NOT AWARD CRITERIA**, taking into account as minimum reference quality level the one defined, explicitly or implicitly, within the project realized by the Contracting Authority, and put out to tender. It is composed by, in addition to the parts listed in this Conditions, bill of quantities, breakdown of prices, requirements specified in the construction drawings and in any case in the design part. In addition, guarantee and overall reliability of the several materials, products and employed technologies are intended as basic quality level.
- BE IN ACCORDANCE WITH ALL EXISTING REGULATIONS**, both national and local legislations, including the several specific technical regulations and all the standards pertaining to occupant health and comfort, taking into account that intervention and each parts of it must comply with them.

### Evaluation of the Technical Offer

As mentioned above, the award criteria of the Technical Offers (see reference *Bando di Gara* and *Schema di presentazione dell'Offerta Tecnica* – in English: Invitation to Tender and Technical Offer Submission Procedure) is based on **PERFORMANCE REQUIREMENTS, NOT ON** *This English language text is a translation from the original Italian, to enable foreign bidders to participate in the tender. In case of doubt, dispute or involuntary errors or omissions, only the original Italian text will be valid.*

**ELEMENTS AND TECHNOLOGICAL FEATURES, PREVIOUSLY SPECIFIED BY THE CONTRACTING AUTHORITY.** It gives the absolute freedom to the competitors to identify the technologies and the procedures, to best fulfil both “desidered” performances from Contracting Authority and the maximum eligible cost.

Will be awarded:

- I. TECHNOLOGICAL INNOVATION OF PRODUCT**, to guarantte better and additional performances, at a cost proportionally lower than good-quality products on the market, used as basis of the invitation to tender;
- II. ABILITY TO FIND OPTIMAL AND INNOVATIVE SOLUTIONS WITHIN THE OVERALL INTERVENTION**, by means of a joint planning between actors and technologies suppliers, to decrease cost and time of execution, obtain economies of scale, improve the offered performances;
- III. COORDINATION BETWEEN ACTORS TO LIMIT INCONVINIENCE TO USERS AND THE CONSTRUCTION SITE MANAGEMENT**, also setting different innovative solutions for operating methods and installation of technologies;
- IV. PRODUCTS AND EMPLOYED TECHNOLOGIES RELAIABILITY**, evaluated on the basis of the specific guarantees defined by manufacturers and installers.

## **DETAILED DESCRIPTION OF THE WORK**

### **Introduction**

The extraordinary maintenance project of the buildings, owned by ALER, placed in Treviglio (BG) in via Dei Mulini (n° 10-12-14-16-18-20, n. 54 housing units) and in via F. Filzi (n° 11 – 13 – 15, n. 54 housing units) has the aim of limiting the energy consumption for space heating, the hygrothermal comfort improvement and the reduction of maintenance cost, by means of intervention on building envelope and systems, with the basic quality and performance level is declared in this Special Conditions of Tender and in all the design documents.

The two buildings have been built in late 70's, early 80's: the first one is a stand-alone volume 4-storey building with complex floor plans (the ground floor is for boxes and porticato); the second one is composed by three 7-storey buildings (the ground floor is for cellars and portico).

### **Art. 01 – General rules**

Works and supplies include all expenditures, materials, labour, equipment, support, etc. required to obtain accomplished and serviceable works with complete finishing, in accordance with the best practice. They shall comply with the rules settled by the Current Special Conditions of Tender.

**THE CONSTRUCTION METHODS AND THE DETAILED DESCRIPTIONS, INCLUDED IN THE FOLLOWING ARTICLES, ARE NOT A TECHNOLOGICAL/TYOLOGICAL RESTRICTION. HOWEVER, THEY REPRESENT THE MINIMUM THRESHOLD OF THE REQUIRED PERFORMANCES, NOT JUST FOR QUALITY AND QUANTITY ASPECTS USED FOR THE OVERALL SCORES AWARDING, BUT FOR THE OVERALL QUALITY PERFORMANCE OF THE INTERVENTION AS WELL, EXPLICIT AND IMPLICIT, INCLUDING THE RELIABILITY AND DURABILITY ASPECTS.**

*Therefore, if working plan documents cover manufactures' name references, they are just an advice and not a restriction. Companies can adpot products from any other*

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*manufacturers, as long as those products have the same or higher requirements in respect with the mentioned ones.*

In case of lacking specifications in the following articles, the general and specific construction methods, employed for new buildings by A.L.E.R. of Bergamo, are the references. In any case, the Contractor must conform to those as basic reference for the not specified works, if they does not conflict with the price list attached to this Tender, to which the Contractor shall comply, except for different provisions by the Construction Supervision (D.L.). D.L. can in any case make use of provisions in Article 163 of the Regulation for all works not foreseen.

For all the residual cases, not included in the Current Special Conditions, it is necessary to implement rules and requirements included in the General Conditions of Tender for works under the authority of Ministry of Public Works (LL.PP.) – D.M. 19.04.2000 n. 145 and in the implementing Regulation of the Public Works framework law, approved by D.P.R. 05.10.2010 n. 207.

Concerning technologies, products and materials without any specified manufacturer, invented name and technical specifications in the call for tender (see *Schema di Presentazione Offerta Tecnica*), the Contractor have to disclose a material sampling for the approval. Such samples shall be approved by the Construction Supervision (D.L.) and the latter will keep one serie. Sampling execution in situ could be required. Materials cannot be used without the D.L official approvals of the sampling.

In the first case, the shift is allowed only by a convincing evidence explained by the Contractor and approved by D.L., except for the overall characteristics of building project that led to the awarded score in the call for tender.

The Construction Company shall disclose, for each used materials to be certified, the attestation of conformity CE in accordance with the legislation in force.

The construction materials have to comply with the Construction Products Regulation Cpr n.305/2011 (ex Direttiva 89/106) that established the requirements for the marketing of construction products. The requirements are:

- mechanical resistance and stability;
- safety in case of fire;
- hygiene, health and environment;
- safety and accessibility in use;
- protection against noise;
- energy economy and heat retention;
- durability (within the sustainable use of natural resources).

The Contractor has to follow what is provided for by D.P.R. 05.10.2010 n. 207 art. 15 comma 4 (in italian): *“Al fine di poter effettuare la manutenzione e le eventuali modifiche dell'intervento nel suo ciclo di vita utile, gli elaborati del progetto sono aggiornati in conseguenza delle varianti o delle soluzioni esecutive che si siano rese necessarie, a cura dell'Appaltatore e con l'approvazione del Direttore dei Lavori, in modo da rendere disponibili tutte le informazioni sulle modalità di realizzazione dell'opera o del lavoro”*.

In the end, all the documents related to the tender, including also the existing heating system plan, blueprint and original papers are available to the Contractor at ALER offices.

## **Art. 02 – Total days of non usability of housing parts**

The aim of the Contracting Authority is to reduce the discomfort of the occupants, minimizing the number of days in which the occupants have to leave parts of their house in order to let the intervantion accomplished.

**The tender basic requirement is:**

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Total days of non usability of housing parts:  $\leq 5$  days

The number of days for each housing unit is the sum of the periods when the users cannot freely occupy part of their house, equal to 1/2 day if the non-usability exceeds 2 hours per room. Below 2 hours non-usability is not considered.

### **Art. 03 – Total days permitted for intervention in each housing unit**

The aim of the Contracting Authority is to reduce the discomfort of the occupants, minimizing the maximum number of days necessary to accomplish the intervention in each housing unit.

**The tender basic requirement is:**

Total days permitted for intervention in each housing unit (non usability days included)  $\leq 9$  days

The number of days for each housing unit starts from the staff entrance for the first work, and finishes with the staff leaving after the last work. Evidently also non usability days are included as referred to in Art. 02.

Technical on-site surveys for the operations assessment and the possible activation /calibration of internal equipment are excluded from the time interval.

### **Art. 04 – Sensory discomfort reduction for the users, healthy and eco-friendly materials**

The aim of the Contracting Authority is to reduce the sensory discomfort of the occupants, increasing the health and the use of eco-friendly materials in each housing unit.

**The tender basic requirement is:**

No minimum requirement is fixed, because it is already declared in the rules in force.

Since equipment and materials used during the working phase have to comply with the existing rules, including risk reduction, workers' and users' health and with the environment damage minimization, the aim of the Contracting Authority is adopting measures to reduce inconvenience and sensory discomfort for the user and the expected health and environment hazard, during the working and laying phase inside the housing units.

Risk factors for inconvenience and sensory discomfort, in this tender, are listed below in order of importance:

- a. dust release into environment;
- b. noise generation;
- c. unpleasant smell emission.

The reduction of hazard for health and environment is guaranteed by using materials and products with environmental certification or complying with comparable standards or

using non-toxicity and eco-friendly materials and components products, proved by analysis and tests carried out by certified European Institutes.

## **Art. 05 – Acoustic insulation improvement in the housing units**

The aim of the Contracting Authority is to improve the housing unit acoustic insulation against outdoor sound. In function of the building construction technology, type of intervention for the envelope and given that the standardized noise insulation index for facades  $D_{2m,nT,w}=40\text{dB}$  must be obtained taking into account also each window and door frame requirement, the focus of the intervention is the replacement of shutters doors and windows.

**The tender basic requirement is:**

Minimum apparent sound reduction index of the integrated system window/shading and solar radiation control device:  **$R_w \geq 38 \text{ dB}$  in accordance with ISO 140-3 and EN ISO 717-1.**

The official tests carried out by certified European laboratory, in accordance with EN ISO 140-3 and EN ISO 717-1, are effective for the assessment.

The overall minimum quality level, required for the integrated system as mentioned above, in addition to the acoustic performance, is declared in the **Paragraph 08.04**.

If a passive or active air ventilation system is combined with the door and window frame, considering a 24 hours long activation of the air ventilation, the performance assessment is based on an open system method.

## **Art. 06 – Air quality assurance in the housing units**

The aim of the Contracting Authority is to obtain the guarantee of the provided air change rate as declared in UNI EN 15251:2008 and UNI 10339, during 24 hours and in each room, with relative humidity and pollutants level control (CO<sub>2</sub>, VOC, etc.). Indoor air quality is obtained, as usual, by shutter joints infiltration that ensure the standard required air change per hour. Replacing the existing windows with better energy efficient systems, the ventilation rate is in doubt and depending on the personal decision of shutter opening.

**The tender basic requirement is:**

The minimum requirement requested by the Contracting Authority is the use of windows and doors systems as referred to in **Paragraph 08.04**

The proposed systems, in addition to ensure the air change rate recommended by regulations, during 24 hours, taking into account building Category II, in accordance with UNI EN 15251:2008, do not have to produce noise due to operating mechanism (fans, electric actuator, etc.). They have to ensure the control of noise derived from the outdoor air-intakes, avoiding reduction of the envelope acoustic insulation, and the sound transmission into housing units, if pipes run through several rooms.

## **Art. 07 – Reduction of primary energy demand for space heating**

The aim of the Contracting Authority is to achieve the overall reduction of primary energy demand for space heating, calculated as average of the two buildings, and higher than the value achievable by means of the minimum interventions as defined by the Contracting Authority.

**The tender basic requirement is:**

Overall reduction of primary energy demand for space heating, calculated as average of the two buildings and assessed using the energy certification of buildings calculation method of Regione Lombardia (CENED+1.2): **R ≥ 47.00%**.

This goal shall be achieved keeping the following **minimum** percentage reduction of primary energy demand for space heating for each building: Via F. Filzi **R = 35.00%**, Via dei Mulini **R = 54.00%**.

**In light of the evaluation criteria explained in the Contract Document “Disciplinare”, the reduction of energy demand lower than the prescribed minimum requirement, even if just for one of the building subjected to extraordinary maintenance, does not allow the exceeding of the minimum threshold by competitor to gain access to financial offer evaluation phase.**

The above-mentioned requirements derive from the results of the interventions defined by the Contracting Authority after the energy assessment of the existing two buildings in Via F. Filzi and in Via dei Mulini.

To ensure all the competitors can evaluate the results obtained by their proposals with the same evaluation method, the primary energy consumption for space heating, for the existing buildings and for the designed ones, has been evaluated by means of the energy certification of buildings calculation method of Regione Lombardia (version CENED+1.2). The competitors have to demonstrate the achievable saving with the offered interventions using the same calculation method (CENED+1.2) free downloading on the website [www.cened.it](http://www.cened.it). The Contracting Authority makes available \*.xlm file exported from calculation software used for the energy assessment of the existing two buildings, envelope/plants system.

**THE COMPETITORS CAN FREE OPERATE ON BUILDING ENVELOPE AND SYSTEMS, TO IMPROVE THE ENERGY PERFORMANCE OF SPACE HEATING IN THE TWO BUILDINGS, BUT THE FOLLOWING PARAGRAPHS OF THE CURRENT ARTICLE 7, SPECIFY THE ENERGY EFFICIENCY PERFORMANCE LEVELS AND THE MINIMUM QUALITY PROPERTIES OF THE ENVELOPE/SYSTEMS. ELEMENTS AND INTERVENTIONS ARE HOWEVER ESTABLISHED AND REQUIRED TO THE COMPETITORS, REGARDLESS OF ANY OFFERED INNOVATIVE TECHNOLOGICAL SOLUTION.**

In any case, offered interventions shall comply in full with the regulations in force at the time of the offer submission and shall bring into line to possible variations of regulations, occurred before the award of the contract.

### **07.01. – Reference standards for safety of the systems and for energy upgrading**

The rules included in D.M. n. 37 / 22-01-2008, regulation about the enforcement of the art. 11 quaterdecies, comma 13, letter a, of the law n. 248 - 2 December 2005, about the instructions for the building facilities installation, shall be abided by.

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In particular according to art. 7, at end of works after controls for the acceptance dictated by the regulations in force, including the electrical system functioning, the contractor have to deliver, to the Contracting Authority, the conformity declaration of the facilities made in accordance with the best practice and CEI regulations.

With regard to the energy upgrading of the system envelope/plants, including the thermoregulation, the regional standard DGR 8745/08 art. 6.1, about plants greater than 100,000 Kcal/h, in case of extraordinary interventions as the current ones, commits the energy assessment report. This report shall be attached to the project documents.

With the executive order law “Decreto” n. 6480 - 30/7/2015, after the Regional Council Approval n. 3868 - 17/07/2015, Regione Lombardia has recognized the national law DM 26/6/2015, whit some dissimilarities, described within DGR 3868 and adopted for the energy performance calculation of the two buildings owned by Aler in Treviglio.

About thermoregulation, Regione Lombardia, in accordance with D. Lgs 102/2015, has recognized DGR X/3965 - 31/07/2015, establishing in comma 8 art. 10 that for the proper partition of the costs for heating and cooling plants and for centralized domestic hot water, the overall value shall be split in function of the voluntary actual use of the energy and in function of the plants maintenance general costs, in accordance with the standard UNI 10200:2015.

The installer has the charge to disclose the table of the heat input of the installed plants, calculated by means of dimensional method as in annex D of the above-mentioned UNI standard, and likewise in accordance with UNI EN 442:2015 for the installation of the effective heat output distribution frame.

## **07.02 – Attic roof insulation**

The thermal insulation of attic roof shall be carried out in order to achieve the overall thermal transmittance  $U \leq 0.29 \text{ W/m}^2\text{K}$  of the top slab.

The intervention shall comply with the hygro-thermal behaviour verification according to law, to avoid interstitial condensation and guarantee the long-term energy performance of the new construction system. The overall physical and performance properties have to be ensured over time.

Before laying the new panels, the existing deteriorated insulation materials shall be removed and disposed (expanded clay and glass wool must be packed), together with the other existing residual materials, and the surface have to be cleaned.

## **07.03 – Wall external insulation**

At the external side of the two buildings, at the frontal part (made with fair-faced reinforced concrete and plastic coating) an insulation shall be provided, in order to achieve the overall thermal transmittance  $U \leq 0.29 \text{ W/m}^2 \text{ K}$  of the opaque vertical enclosure.

The intervention shall comply with the hygro-thermal behaviour verification according to law, to avoid interstitial condensation and guarantee the long-term energy performance of the new construction system. The overall physical and performance properties have to be ensured over time.

Thermal bridges, due to geometric configuration, building construction and implemented technology, have to be reduced at the least. In any case, the thermal bridge verification of intervention shall comply with the regulations in force.

The anchoring and fixing systems to the wall of the new materials and load-bearing or structural elements have to be proved by “in situ” testing (e.g. tearing strength test) in order to verify the suitability for the real construction.

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The execution of intervention on the existing frontal part (made with fair-faced reinforced concrete and plastic coating) must be preceded by optimal surface treatment, suitable for the technology type, including, for instance, string-course and other possible difference in height, levelling and resuming the parts with lack of cohesion.

The execution of intervention cannot start if the structure are not protected against weathering, namely when driven rainwater can wet the surface and when the minimum temperature during 24 hours cannot permit the success of operation.

If necessary and if observed during the working phase, "technical cut" must be forecast to avoid visible differences of the facade finishing layers.

The colors are chosen by D.L., after adequate sampling.

If the intervention concerns the installation of an External Thermal Insulation Composite System - ETICS, it shall comply with ETAG004 (European Technical Approval Guidelines for ETICS). It shall comply with also the technical specifications: UNI EN 13499 in case of expanded polyester insulation and UNI EN 13500 in case of mineral wool insulation, and UNI 10997 for the finishing layers, about the procedure for painting cycles and protective coating laying.

If the intervention concerns the installation of a "ventilated curtain wall", it shall comply with the reference technical specifications, especially: UNI 11018 "Rivestimenti e sistemi di ancoraggio per facciate ventilate a montaggio meccanico - Istruzioni per la progettazione, l'esecuzione e la manutenzione - Rivestimenti lapidei e ceramici"; UNI EN 12152:2003 "Curtain walling. Air permeability. Performance requirements and classification "; UNI EN 12179:2002 "Curtain walling. Resistance to wind load. Test method "; UNI EN 13116:2002 "Curtain walling. Resistance to wind load. Performance requirements "; UNI EN ISO 13786:2008 "Thermal performance of building components -- Dynamic thermal characteristics -- Calculation methods"; UNI EN 13830:2015 "Curtain walling. Product standard".

The new insulation system must be completely certified and with guarantees. The latter shall be:

- minimum 5 years insurance policy, for the used materials and components performance;
- insurance for laying and installation defects occurred within 5 years, by means of insurance policy granted to the Contractor (construction company).

To realize the intervention complying with the best practice the balcony railings (last vertical side element) and, potentially, the specific fixing systems can be modified to allow the placing of insulating slabs. The modified railings must be repainting as the existing ones. If removed, the existing floor ceramic clay baseboards must be made ex novo with the same materials and dimension of the existing floor (red ceramic clay tiles dim. 7 x 12 cm).

The contractor have to move and replace, after ETICS installation, downspout (including new banding angles), lamps, heating sensors, etc., and whatever at the facade.

### **07.03.bis – Ceiling insulation of the ground floor (box, cellars, access room, equipment rooms, etc.)**

An insulation system must be realized for the ceiling of the ground floor of the two buildings in via Filzi and in via Dei Mulini, in order to achieve the overall thermal transmittance  $U \leq 0.318 \text{ W/m}^2 \text{ K}$  of the dispersion horizontal opaque enclosure.

The technology, due to dimension limits in height, (windows and hopper windows reach the ceiling), should guarantee good performance with reduced thickness.

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The intervention shall comply with the hygro-thermal behaviour verification according to law, to avoid interstitial condensation and guarantee the long-term energy performance of the new construction system. The overall physical and performance properties shall be ensured over time.

Thermal bridges, due to geometric configuration, building construction and implemented technology, shall be reduced at the least. In any case, the thermal bridge verification of intervention shall comply with the regulations in force.

The finishing layer must be a two coating washable opaque water-based paint, white or light color as established by D.L.

The new insulation system must be completely certified and with guarantees. The latter have to be:

- minimum 5 years insurance policy, for the used materials and components performance;
- insurance for laying and installation defects occurred within 5 years, by means of insurance policy granted to the contractor (construction company).

#### **07.04 – Insulation behind radiators**

An insulation shall be installed at the portions of the wall behind the heating elements, in the two buildings housing units, in order to achieve the overall thermal resistance  $R \geq 1.42 \text{ m}^2\text{K/W}$ . The intervention can be made at internal side of the wall, behind the radiators, or external side as well.

In case of the inner side intervention, heat-reflecting products can be used, in order to increase the emission efficiency of the heating elements.

The intervention shall comply with the hygro-thermal behaviour verification according to law, to avoid interstitial condensation and guarantee the long-term energy performance of the new construction system. The overall physical and performance properties shall be ensured over time.

Thermal bridges, due to geometric configuration, building construction and implemented technology, shall be reduced at the least. In any case, the thermal bridge verification of intervention shall comply with the regulations in force.

#### **07.05 – New windows and shading and solar radiation control systems**

The existing windows (varnished steel double glazing unit with untreated clear glass) and the shading and solar radiation control systems (PVC domestic rolling shutters with uninsulated box) in the two buildings must be replaced by systems with the global thermal transmittance  $U_w \leq 1.30 \text{ W/m}^2\text{K}$ , able to guarantee shading and solar radiation control, equal or higher than the reference one, with insulated rolling shutter box if existing.

All the windows/shading and solar radiation control system, with auxiliary equipment and rolling shutter boxes, if existing, shall be adjusted, regulated and inspected in order to make them entirely serviceable. The total inspection of ALL windows before the delivering is Contractor's responsibility.

##### **07.05.a - Windows**

Windows (and doors) shall have the following minimum requirements (standard UNI EN 14351-1:2006):

- Air permeability class 4, in accordance with UNI EN 12207

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- Water tightness: minimum A9 class in accordance with UNI EN 12208
- Resistance to wind load: minimum C4/B4 class in accordance with UNI EN 12210
- Global thermal transmittance  $U_w \leq 1.30 \text{ W/m}^2\text{K}$  (as in energy assessment report)
- Minimum apparent sound reduction index:  $R_w \geq 38 \text{ dB}$  in accordance with EN ISO 717-1

The apparent sound reduction index value of the windows, including glazing and rolling shutter boxes, shall be measured in the laboratory in accordance with ISO 140-3 and ISO 717-1.

With no prescription (or lacking prescription), they, as a whole, shall anyway be realized in order to withstand the mechanical and weathering stresses and contribute to the conservation of indoor thermal, acoustic, lighting and air ventilation conditions, etc.

They have to ensure the overall physical and performance properties of the intervention over time.

In particular, the manufacturers/sellers are required to provide the following guarantees:

<u>Required performance</u>	<u>Required Duration</u>
- Overall windows serviceability	$\geq 5$ years
- Surface discolouring	$\geq 6$ years
- Double glazing condensation	$\geq 5$ years
- PVD treated handles corrosion	$\geq 5$ years
- Windows equipment serviceability	$\geq 3$ years

Thermal bridge at junction between the new frame and the existing iron secondary frame has to be inspected, and the compatibility with a possible new external insulation of all opaque vertical enclosure not subjected to the current intervention shall be proved (design details to submit for the participation to the tender). The sealing between frame and subframe has to be ensure by means of aerophilous foam or different materials adequate in terms of effectiveness and duration.

In any case, the thermal bridge verification of intervention shall comply with the regulations in force.

Taking into account the intervention type, that is without masonry works, minimizing the occupants discomfort, and the basic required performances, any shutter systems, in order to ensure the above-mentioned functional requirements and/or improve them, can be selected.

Furthermore the characteristics, submitted in the technical offer, which lead to a simply, quick and less onerous replacement of the glazing and of the metal ware of the windows, doors, shading and solar radiation control system, are awarded.

French windows must have redundant support placed at about cm 85/90 from the floor.

D.L. can accept the windows typologies verifying:

- their composing materials, protective treatments and coatings and verifying glazing, sealants or sealing strips, equipment;
- their construction characteristics, specifically, cross section dimension, joint feature, mechanical fixing (screws, bolt, etc.) or gluing fixing (glue, adhesive, etc.);
- each construction part, affecting the mechanical resistance, water, air and wind tightness, and all the other required performances.

The marking attesting conformity (with declared performances) shall be proved by adequate certification and documentation.

For not above-mentioned, the amendment are the specific technical standards: UNI EN 12207, UNI EN 12208, UNI EN 12210, UNI EN 12211, UNI EN ISO 10077, UNI EN 179, UNI EN 1125, UNI EN 1154, UNI EN 1155, UNI EN 1158, UNI EN 12209, UNI EN 1935, UNI EN 13659, UNI EN 13561, UNI EN 13241-1, UNI 10818, UNI EN 13126-1, UNI EN 1026 UNI EN 1027.

All products and / or materials within the current article, if they can be equipped with CE marking in accordance with technical requirements, shall be equipped with this mark.

In general, new doors and windows shall respect the opening direction of the existing ones; the contractor shall previously measure and verify in-situ before the supply.

The contractor shall submit to the D.L., together with windows sampling, the technical approval certification issued by ICITE or by different independent institution. If no technical approval is submitted, the windows sampling will be rejected in incontestable way.

The glazing shall have an indoor tempered safety glass or shockproof multilayer glass. The latter shall be used in the french windows up to 1 m from the floor. Alternative technical solutions are allowed if they ensure the same safety level. The glasses shall be in accordance with the standard UNI 7697/2014.

The inner windows shall be equipped with a profile ("scossino") made with adequate material closing the existing marble panel. The colour shall be the same of the windows.

#### **07.05.b – Shading and solar radiation control systems**

The shading and solar radiation control systems as a whole shall withstand the mechanical stress (wind, shuttering, etc.) and weathering stress keeping the performance over time.

In case of rolling shutter boxes for shading and solar radiation control system, they shall be satisfactorily insulated in order to ensure the thermal transmittance  $U_w \leq 1.30 \text{ W/m}^2\text{K}$  of the entire window system.

D.L. can accept the shadings verifying the materials, coatings, equipment and operating parts materials, their construction characteristics, specifically, cross section dimension, features of the joints mechanical fixed (screws, bolt, etc.) or gluing fixed (glue, adhesive, etc.), and each construction part, affecting the mechanical and weathering resistance and the durability.

D.L. can accept the supplying by means of marking attesting conformity of the mechanical resistance, weathering stress resistance (corrosions, UV lamp radiation aging cycles, climatic chamber, etc.). The attesting conformity shall be proved by adequate certifications and/or documentation.

The colour shall be the same of the existing one and anyway under D.L. decision.

#### **07.06. – New downspouts**

In case of the building in via Filzi the old deteriorated PVC downspouts shall be replaced by new ones made of a prepainted sheet metal with thickness equal to 6/10 of the diameter as the existing, and that is 10 cm.

The downspout shall be inserted into the existing cast iron junctions; furthermore, the ones placed against the wall to be thermal insulated, taking into account the thickness increasing, shall have adequate offsets and adapters.

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## 07.07 – Heating system

In the following paragraph are described the works declared by The Contracting Authority for defining the reference Project, about the extraordinary maintenance of the heating systems for the two buildings, and some rules and prescriptions the competitor shall comply with during the preparation of the Project bid.

Works description is supplementary and explicative of the Bill of Quantities (or Quantity Survey), technical reports, and drawings, which are available to the competitors.

The competitor can in any case operate, with different design and technological solutions to improve the heat generation, distribution and management, covering the new energy demand of the two buildings, gained through the several efficiency-upgrading interventions in the offer.

Clearly, the overall quality of the intervention and of its parts cannot be reduced. The quality, implicit and explicit, is declared by interventions description within this paragraph, and by Bill of Quantities, technical reports and drawings.

### 07.07.01 - In common criteria and recommendations for the system design

The adopted criteria for energy performance calculation, sizing of piping and thermoregulation system, are the same for the two buildings placed in Treviglio, via Dei Mulini n. 10/20 and in via Fabio Filzi n. 11/13.

The system design for the building in via Dei Mulini includes also the replacement with new heat generators due to wear of the existing ones and their combustion (burning rate) efficiency values recorded, after burning tests, in the plant leaflets.

- a) Heating fluid distribution – Distribution through pipes and all heaters (radiators) shall be ensured by supplying the needed energy corresponding to the maximum power fraction declared within the project.

In the accelerated circulation systems such as those in Via F. Filzi and Via Dei Mulini free passage of water must occur, regardless of the accelerator, in connection with the adoption of the pumps constructed for the purpose, with size and type indicated in the documents of the project, or by bypass using the related shutters.

One or two units, with a reserve, of equal power, shall constitute the accelerator when the rooms of the entire building shall be simultaneously heated.

If the plant is split in more circuits, having different requirements and operating time, each circuit shall be served by one or more units, with a reserve, for a heat output not lower than the required one to each circuit.

In the secondary piping, water velocity should not normally exceed 1 m/s, while in the main piping, 2 m/s. If, in exceptional cases, a slightly higher speed is expected, it shall not cause vibrations and noise disturbance, under any circumstances.

- b) Piping - The existing pipe runs in the basement and embedded in the walls as well, and anchored in order to allow their movements due to thermal effects. If necessary, in case of lack or deterioration, the pipes shall be thermally insulated. Even for the visible ones, the contractor shall check the state of wear and integrate insulation where the heat losses reduction is necessary to guarantee.

The new pipes must follow the shortest path, consistent with the best operation of the system, and be arranged in space-saving manner.

If it is not possible to ensure by other means the free crossing of pipes through walls and floors, its passage must be executed within walled tube.

The risers and downcomers shall be equipped with stop valves and drain valves at the lower ends. If it is necessary, to balance the system after the installation of the new thermostatic valves, the contractor shall verify the circulating flow rate and insert, at the base of the columns, flow or pressure controls.

The risers shall be equipped with the extensions for the automatic air vent at the upper ends. For systems provided for closed expansion vessels, the air venting pipes may be replaced by automatic or manual vent valve.

Generally, connections, leads, (installed with screw or sleeve, or with flange, or by means of autogenous welding), supports and fixings must be integrated into all pipes. The pipes themselves must also be provided with shut-off valves of the main branches and the required expansion joints, taking into account also the existence of expansion joints in case of reinforced concrete structures.

In addition, all the piping in unheated rooms must be covered with suitable thermal insulating material, as shown in Annex B of Presidential Decree (D.P.R.) 412/93 and subsequent amendments.

The insulation shall be carefully realized with appropriate insulating materials, non-combustible or oxidizing, non-hygroscopic, impervious to chemical, physical agents and parasites.

- c) Power supply of the plant - The water for the power supply will be derived from the distribution network, into the interior of the building, at the point that will be indicated and derived from the storage and expansion tank. It will also have to be foreseen the drain up to the next tap.

Taking into account the available characteristics of the water, to be defined, the Contractor must provide a purification system for the water. The capacity of the filtration must ensure the supplying for five days.

- d) Radiators - The maximum value of the average temperature difference of water in the heating elements, between input and output, must not exceed 15 ° C in the forced circulation system.

The temperature difference of water, between risers and downcomers, in boilers or in the devices mentioned above, must correspond to the above average differences, increased by the temperature drop for transmission along the pipes.

The thermal emission of any heating elements must comply with UNI EN 442-1-2-3. The sizing must be made taking into account the actual difference between the average temperature of the radiator and the indoor environment.

The contractor shall carefully carried out, the balance of the flow rate, following the installation of the mechanical actuators as required, and the calibration of the operating parameters (climate controller, modulation ratios, etc...), in order to maintain the working temperature of the fluid as small as possible in relation to the radiators demand. The aim is to reduce the existing plant losses and increase the efficiency of condensing boilers (for example, with an external design T and external T + 8 ° C). A report is required in order to transfer data to the manager who will keep the adjustments over time.

## **07.07.02 – Heating plant in Via Fabio Filzi n. 11/13**

### **02.01 - Works description and technical specifications**

- Operations of rehabilitation and cleaning of the hydraulic circuit of the existing heating

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system, before installing the new plant equipment, constituted by the low pressure washing (pickling) of the circuit, to eliminate the presence of any ferrous impurities and sediments;

- Supply of electronic hydraulic circulation system, with variable flow rate, for accelerated circulation, at the manifolds, one equipped by a standby pump. In particular it has: scale A and B ( Q = 8.3 mc/h and H = 7.0 m.c.a. ) and scale C ( Q = 6.75 m.c.h and H = 8.0 m.c.a);
- Supply and installation of dirt separator, mounted on the downcomers of the primary circuit;
- Supply and installation of air-vent valve, mounted on the risers of the primary circuit;
- Supply and installation of automatic filling unit and demineralization mounted on the existing cold water network;
- Supply and installation of automatic air vent valves to be mounted on the piping (in the boiler room) at high points where air formation occurs, and of adjustable differential by-pass valves with graduated scale for balancing the secondary circuits;

The heating system has been upgraded in accordance with Legislative Decree no. 192 19 August 2005, Legislative Decree no. 311 29 December 2006, Presidential Decree D.P.R. n. 59 April 2, 2009, D.M. June 26, 2009 and according to the methodology and technical specifications given in the UNI standards.

Moreover, physical and overall performance characteristics of the parts subjected to the intervention shall be ensured over time.

In particular, the following guarantees are required to the manufacturer/seller:

<u>Technologies</u>	<u>Guarantee of Duration</u>
Electronic circulating pumps:	
- Electronic parts serviceability	≥ 3 years
- mechanical and electromechanical parts serviceability	≥ 3 years

### **07.07.03 - Heating plant in Via Dei Mulini n. 10/20**

#### **03.01 - Works description and technical specifications**

- Disassembly of the existing heat plant including: the demolition of the boiler and burner, the cut of the main risers and downcomers up to the main collector; disassembly of the existing ISPEL equipment, circulators and electric panel including the ducts containing the power and signal cables, and the connections; loading of the equipment on the truck, transport of the waste and disposal;
- Supply and laying of new stainless steel flue in single wall including gas removal plaque and thermometer, and of the new stainless steel flue double wall to be placed in the existing outdoor cavity which consists of removable prefabricated steel panels;
- Operations of rehabilitation and cleaning of the hydraulic circuit of the existing heating system, before installing the new plant equipment, constituted by the low pressure washing (pickling) of the circuit to eliminate the presence of any ferrous impurities and sediments;
- Supply and installation of the two new condensing generators in cascade system, natural gas fuelled, with total heat output modulation, and realization of the new condensate draining system with neutralization kit to be connected to the existing sewerage;

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- Supply and installation of new digital climate control unit (definition of the temperature curve according to the actual user heat demand and thermal inertia of the building) in place of the analogue, including probes in the risers, the pump control, modulating burner, the cascade operation of the two boilers, and parameters compensation with the external probe placed in the north facade;
- Installation of new hydraulic circuits, connecting the two boilers with the existing distribution manifold, and visible laid in the heating plant, as indicated in the design documents;
- Execution of the insulation of existing and new pipelines;
- Supply and installation of open collector or hydraulic separator, inserted to eliminate interference between the primary and secondary circuits, sized taking into account the fluid velocity of 0.1 m/s and flow rate of 8,757 l/h with the following operating parameters: the primary circuit at temperatures of 70 ° C in risers and 55 ° C in downcomers, with flow rate equal to 18,343 l/h and the secondary circuit with temperatures of 65 ° C in risers and 55 ° C in downcomers, with flow rate equal to 27,100 l/h;
- Supply and laying of dirt separator, mounted on the downcomers in the primary circuit;
- Supply and installation of air-vent valve, mounted on the risers in the primary circuit;
- Supply and installation of automatic filling unit and demineralization mounted on the existing cold water network;
- Supply and installation of automatic air vent valves to be mounted on the piping (in the boiler room) at high points where air formation occurs and of adjustable differential by-pass valves with graduated scale for balancing the secondary circuits;
- Supply of twin electronic and variable flow rate circulators, mounted on the primary circuit risers (  $Q = 9,2 \text{ mc / h}$  and  $H = 1.5 \text{ mca}$  each) and on the downcomers of two hydraulic circuits at manifolds and a third one with stand-by pump, already prepared for the supply of plant networks in ABC stairs ( 27 units ) (  $Q = 14.30 \text{ mc/h}$  and  $H = 7.0 \text{ mca}$  ) and CDE stairs (27 units) (  $Q = 12.30 \text{ mc / h}$  and  $H = 7.0 \text{ mCA}$ ) of the building;
- Transformation of the natural gas supply network with the extension of the existing piping and the realization of two branches including the gas shut-off valves, the pressure gauge equipped with opening button, the filter, the controller and the vibration damping joint;
- Installation of natural gas leak detection system consisting of automatic fuel shut-off valve, the natural gas detection unit, rotating alarm, intermittently electronic flashing and external gas solenoid valve with 2 " connection and built-in sensor;
- Supply and installation of portable fire extinguishers.

Being the system with over 350 kW rated power, in the Contracting Authority's Project two heat generators have been provided, identified on the detailed design drawings, as indicated in Art. 5 paragraph 5 of Presidential Decree D.P.R. 412/93 and subsequent amendments.

The generators are separately connected to two manifolds, one for the rising water and the other for the downcoming water and each unit can be isolated from the collectors by means of gate valves, by means of devices necessary to ensure the free expansion of water contained in the boilers and thereby to exclude the formation of overpressure when the shutters are closed (by-pass piping or hydraulic separator).

Moreover, physical and overall performance characteristics of the heating plant shall be ensured over time.

In particular, the following guarantees are required to the manufacturer/seller:

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Technologies	Guarantee of Duration
Condensing boiler:	
- Heat exchanger serviceability	≥ 5 years
- Electronic parts serviceability	≥ 5 years
Electronic circulating pumps:	
- Electronic parts serviceability	≥ 3 years
- Mechanical and electromechanical parts serviceability	≥ 3 years

All products and / or materials used, if they can be equipped with CE marking in accordance with technical requirements, shall be equipped with this mark.

### 03.02 - Criteria and recommendations for the system design

- a) Expansion tanks - When hot water circulates in the radiators, the diaphragm expansion tanks, equipped with automatic air vent valve, must have the capacity to contain completely, with sufficient excess, the volume increase that occurs in the water existing in the system, in dependence of the maximum permissible temperature for the same water in the hot-water boilers.

When necessary, the heating elements must be well protected against freezing by means of suitable insulating coating and with all the equipment, such as bunkering pipe, safety light, in communication with the boiler and with the above devices, and with the draining system.

The discharge lamp shall be placed in a visible place in the boiler room or in other room constantly frequented by security staff.

No shut-off device must be interposed along the pipe between the expansion tank and the boiler. The expansion tank and other safety devices of the system must be designed as shown in the collection R of I.S.P.E.S.L.

If closed expansion tanks, self-pressurized or pressurized, have been chosen, they must follow the instructions given in the collection R, for the design and adoption of safety systems.

- b) The isolation of new pipes in the heating plant, due to the modification for the inclusion of new heat generators, shall be done according to the Presidential Decree D.P.R. 412/93 and subsequent amendments.
- c) For the heating system design and sizing, object of the offer, the following requirements are valid:
- I. External temperature – the minimum external temperature for the design of the heating system is established by law and it is -5°C for the municipality of Bergamo.
  - II. Room temperature and system adjustments – the system must be able to ensure, in the heated rooms, the temperatures set out in the project, namely 20°C, with a tolerance of plus or minus 2°C.

The temperature, as prescribed in paragraph b), shall be maintained with the use of a power lower than the maximum resulting from the calculation, with the external temperatures occurring above the minimum established in paragraph a)

Defined the load factor **m** as the ratio of the differences between the average internal temperature, **t1'**, and the average external temperature **te'**, measured at the time of testing, and the corresponding internal, **ti**, and external, **te**, temperatures referred to points b) and a):

$$m = \frac{t1' - te'}{ti - te}$$

the system must ensure the internal temperature with the tolerances allowed for the load factor values between 0.45 and 1.

Temperatures **ti** and **te'** must differ only by the tolerances allowed.

The power reduction, being the maximum equal to the unit, will be a function of the load factor.

- I) Water temperature - The maximum value of the water temperature difference, between the risers and the downcomers in the heat generator, in correspondence with the maximum power of the system, shall be:
  - for forced circulation hot water systems, equal to 10 °C, and exceptionally to 15 °C. In addition, this case must be clearly proposed and justified.
  - for temperature differences, in the heat generator, greater than those indicated above, must be given the technical justifications that led to the adoption of such temperature differences;
- II) Air changes rate - For direct heating with natural ventilation 1/2 air change per hour is prescribed for the heat demand calculation;
- III) Hygrometric condition - For direct natural ventilation heating system, the indoor relative humidity during the winter is not controllable, but if the system is operating, it shall not be greater than 65 % (normally the 50 %), using for the calculation the outside relative humidity of 80 % corresponding to the outdoor temperature set as the lett. a).
- IV) Pre-heating – Full operability of the heating system (direct, full load running and/or with intermittent running part of about 14 hours in the 24 hours of the day) must be reached within 2 hours.

As above, after a regular management of at least 7 consecutive days for the heating systems.

Heat generators shall ensure, in the cases provided by the Legislative Decree no. 192 19 August 2005, Legislative Decree no. 311 29 December 2006, Presidential Decree D.P.R. n. 59 2 April 2009 and by D.M. 26 June 2009, an overall average seasonal efficiency not less than:

$$etag = (75 + 3 \log Pn) \%$$

where:

- **Pn** is the base-10 logarithm of the rated power output (power at nominal load) of the heat generator or generators of the individual heating system, in kW;
- **etag** is the product of the following average seasonal efficiency:
  - efficiency of generation
  - efficiency of control

- efficiency of distribution
- efficiency of emission

and must be calculated according to the methodology and technical specifications given in UNI / TS 11300-2 : 2014 , UNI EN 15316-2-1 : 2008 , UNI EN 15316-1 : 2008 and related standards.

The boilers will have to be equipped with the specified devices in art. 11 of P D.P.R. 1391/70.

The efficiency of hot water heat generators, with nominal power output up to 400 kW, shall respect the limits indicated in the table below:

**Table of efficiency data calculation**

Generator type	Power output range kW	Efficiency for full load		Efficiency for intermediate load	
		Boiler average water temperature (°C)	Efficiency (in %)	Generator average water temperature (°C)	Efficiency (in %)
Standard boilers	4 - 400	70	$\geq 84 + 2 \log P_n$	$\geq 50$	$\geq 80 + 3 \log P_n$
Low temperature boilers (*)	4 - 400	70	$\geq 87,5 + 1,5 \log P_n$	40	$\geq 87,5 + 1,5 \log P_n$
Condensing boilers	4 - 400	70	$\geq 91 + 1 \log P_n$	30 (**)	$\geq 97 + 1 \log P_n$
(*) Including condensing boilers with liquid fuel					
(**) boiler supply temperature					

The efficiency of the hot water heat generators, with nominal power output greater than 400 kW shall meet the performance limits in the table above, calculated by  $P_n = 400$  kW.

The efficiency of the hot air heat generators with a nominal power output not greater than 400 kW shall have a combustion efficiency greater than the minimum at nominal power output:

$$\eta_c = ( 83 + 2 \log P_n ) \%$$

where  $P_n$  is the base-10 logarithm of the rated power output (power at nominal load).

For the nominal power output greater than 400 kW the value of the combustion efficiency must be equal to or greater than the value obtained from the above calculation by  $P_n = 400$  kW

It is appropriate that the chimney, to be built with double-barrel hollow space and in the specific compartment, is with natural draught.

A forced draught chimney is required if there are special needs of particular generators or flue gas path.

In any case the competitor shall specify for which operating conditions such integration is required, namely whether it is always necessary.

The chimney must be dimensioned according to the instructions in the UNI EN 13384.

All products and / or materials used, if they can be equipped with CE marking in accordance with technical requirements, they will be equipped with this mark.

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In compliance with the design rules, the contractor shall produce the theoretical operating diagram, with the indication of the temperatures to be kept in hot-water boilers or in the processing devices, with external temperature varying each half degree centigrade. With the minimum value of the external temperature set at the base of the calculation, the temperature in the boiler or in the devices referred to above should not exceed 85 °C.

At the same time, the contractor shall provide an indication of the number of boilers to be kept operative at different external temperature.

### **03.04 – Electrical wiring system**

The total renovation of the electrical system of the heating plant in Via Dei Mulini no. 10/20 is envisaged, while in Filzi no. 11/13 only the electrical connections of the new pumps shall be replaced, as shown in the attached design documents.

For the wiring of the heating plant in Via Dei Mulini No. 10/20, starting from the main electrical panel of the common areas and up to the above mentioned space, the power cable, including the control and protection switch, upstream installed in the general electric panel, will be replaced.

In the boiler room the new electrical panel will be installed for the electric supply of the devices and for warnings signal of faults.

Electrical distribution will be in sight and the cables laid within the metal conduit with a lid. The conductors will be the FG7OR type and the probes will be connected through shielded bus cable.

The systems shall be made in accordance with the best-practice as prescribed by art. 6, c. 1 of D.M. n. 37 22/01/2008 and subsequent amendments. Systems, made in accordance with local regulations and standards UNI, IEC or other standardization bodies belonging to the EU Member States or that are parties to the Agreement on the European Economic Area, will be considered as best-practice made.

The characteristics of the plant, as well as their components, shall comply with the legal standards and regulations in force at the date of submission of the project-offer and in particular comply with:

- The requirements of local authorities, including those of VV.F.(Fire Department);
- The requirements and instructions from Company's Distribution AEM electricity;
- The requirements and directions from Company Supplier of the Telephone Service;
- The CEI regulations (IEC- Italian Electrotechnical Committee).

#### **Requirements for circuits - Cables and wires:**

##### **a) cable insulation:**

- the cables used in the first-class systems shall be suitable for the earth rated voltage and rated voltage (Uo/U) not less than 450/750V, with designation symbol 07. Those used in signaling and control circuits shall be suitable for rated voltages not less than 300/500V, with designation of symbol 05. The latter, if laid in the same pipe, duct or channel with cables provided with higher rated voltages, must be suitable to the greater rated voltage;

##### **b) cable distinctive colours:**

- the conductors used in the execution of the system shall have to be distinguished by the colours required by the current unification tables CEI UNEL 00712, 00722, 00724, 00726, 00727 and CEI EN 50334. In particular, the neutral and protection conductors shall have to be marked respectively and exclusively with the light blue colour and with the two-tone

yellow-green. As regards the phase conductors, they shall be identified uniquely for the entire system by the colours: black, grey (ash) and brown;

**c) minimum sections and permitted voltage drops:**

- the sections of the conductors calculated in function of the power supply and the length of the circuits (so that the voltage drop does not exceed the value of 4% of the no-load voltage) shall be chosen from among those unified. In any case, the values of the current carrying capacity, for the different types of conductors, cannot be exceeded as listed in the unification tables CEI UNEL 35024/1 ÷ 2.

Regardless of the values obtained with the above-mentioned indications, the permitted minimum sections are:

- 0.75 mm<sup>2</sup> for signaling circuits and remote control;
- 1.5 mm<sup>2</sup> for basic lighting, outlet for plug sockets for other lighting fixtures and equipment with a unit output less than or equal to 2.2 kW;
- 2.5 mm<sup>2</sup> per lead with or without plug sockets for users with unified power greater than 2.2 kW and less than or equal to 3 kW;
- 4 mm<sup>2</sup> for single uprights and lines which supply individual power consumers with a nominal output higher than 3 kW.

**d) neutral conductors minimum section:**

- the section of the neutral conductors cannot be less than the corresponding phase conductors. For conductors in polyphase circuits, with section greater than 16 mm<sup>2</sup>, the section of the neutral conductor can be reduced to half of that of the phase conductors, but with a minimum of 16 mm<sup>2</sup> (for copper conductors), provided that the conditions in art 3.1.0.7 of the CEI 64-8 / 1 ÷ 7 are met.

**e) earth conductors and protection section:**

- the section of earth and protection conductors, such as conductors that connect to the earth the parts to protect against indirect contact, must not be less than indicated in the table below, taken from the CEI 64-8 / 1 ÷ 7:

**PROTECTION CONDUCTOR MINIMUM SECTION**

Section of the phase conductor which supplies the machine or apparatus (mm <sup>2</sup> )	Earth conductor minimum section	
	belonging to the same cable or inserted in the same tube of the phase conductor (mm <sup>2</sup> )	not forming part of the same cable or not threaded in the same tube of the phase conductor (mm <sup>2</sup> )
less than or equal to 5	section of the phase conductor	5
greater than 5 and less than or equal to 16	section of the phase conductor	section of phase conductor
greater than 16	mid-section of the phase conductor with the minimum of 16	16

**Earth conductor minimum section**

The section of the earth conductor must be not less than the above-mentioned protective conductor section with the minimum indicated below:

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Minimum section (mm<sup>2</sup>)

- protected against corrosion but not mechanically: 16 (CU) 16 (FE)
- not protected against corrosion: 25 (CU) 50 (FE)

As an alternative to the above criteria, the calculation of the minimum section of the protective conductor will be allowed using the analytical method referred to in paragraph a) of Art . 9.6.0 1 of the CEI 64-8 standards.

#### **Protective pipes - Pipes path - Junction boxes**

The conductors, unless it is flying installations, must be always protected and safeguarded mechanically.

Such protection may be: pipes, conduits for cables, walkways, ducts or tunnels cut into the building structure and so on. In industrial plants, the type of installation must be agreed from time to time with the Contracting Authority.

In systems of civil buildings and similar shall meet the following requirements:

- In the system envisaged for the implementation under trace, protective pipes shall be light series thermoplastic material for under plastering paths, enamelled steel welded edges or heavy series thermoplastic material for crossings to the floor;
- The internal diameter of the pipes shall be at least 1.3 times the diameter of the circle circumscribed to the cable harness in it. This mark-up shall be increased to 1.5 when the cables are lead or metallic sheath type; the diameter of the pipe must be sufficiently large to allow the cables to be unthread and rethread with ease and without causing the damage of the cables and/or the pipes. However, the inner diameter must not be less than 10 mm;
- The conduit layout shall allow a vertical or horizontal straight line (with a minimum slope to facilitate the discharge of any condensation). The curves must be made with fittings or with wrinkles that do not damage the pipe and do not endanger the possibility to remove the cables;
- Any diversion made necessary by the wall structure, for each lead from main and secondary line and in any supplied room, the pipeline shall be interrupted with junction boxes;
- The conductor joints must be carried out in junction boxes by using suitable terminals or terminal blocks. These boxes shall be constructed so that in the installation conditions is not possible introduce foreign bodies, and heat dispersion produced in them shall be easy. The junction boxes lid shall ensure fixing and can only be opened with a tool;
- The protective tubes of the uprights of user plants supplied through centralized measurement devices and the relative junction boxes shall be distinct for each upright. It will be possible to use the same tube and the same boxes, provided that the uprights give supply to the same complex of rooms and are marked, for their identification, at least in correspondence of the two ends;
- If it is expected that, in the same room, the circuits belong to different electrical systems, these must be protected by several pipes and run to separate boxes. However, it will be possible to place the cables in the same pipe and connected to the same boxes, if they are isolated for the highest voltage and the individual boxes are internally fitted with diaphragms, not removable except by means of a tool, between terminals intended to tighten conductors belonging to different systems.

The number of cables that can be introduced in the tubes is indicated in the tables UNEL

#### **Pipes for prefabricated components**

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The protective pipes embedded in concrete shall comply with the requirements of CEI EN 61386-22.

They will have to be inserted into the boxes, preferably with the use of fittings required to guarantee a perfect fixing. The laying of pipe performed be performed with the utmost care to avoid bottlenecks. Similarly, the tubes have to be joined together by means of suitable coupling sleeves.

The predisposition of the pipes must be performed in accordance with the good technique, taking into account that the prefabricated walls cannot substantial modified neither in the factory nor at the construction site.

The boxes to be inserted in the concrete castings shall withstand the thermal and mechanical stresses that will occur in such conditions. In particular, the rectangular boxes for the devices and the boxes for the electrical panel shall be constructed so that their fixing on the formwork is made with the use of rivets, screws or magnets to be inserted in appropriate spaces formed on the front membrane of the box. The membrane shall ensure the non-deformability of the boxes.

The proposed set of boxes shall be complete with all the elements necessary for the realization of the plant, including the conductors extra boxes needed for descents to the partitions that will be mounted after casting.

#### **Installation of insulated electrical cables, sheathed, underground**

The burying of electrical cables shall comply with the following:

- on the bottom of the excavation, sufficient for the laying depth previously agreed with the direction of work D.L. and devoid of any protrusion or edge of rock or stones, first of all, a bed of river sand, screened and washed, or hollow sieved, shall be relized with a thickness of at least 10 cm, on which the cable (s) shall be stratched out without pressing and without doing it (them) artificially sink into the sand;
- therefore, another layer of sand as above shall be applied with the thickness of at least 5 cm, in correspondence of the upper generatrix of the cable (or cables). The final overall thickness of the sand, therefore, must be at least 15 cm, plus the diameter of the cable (the one greater, having more cables);
- on the sand, finally a continuous row of solid bricks, shall laid well matched and drawn near the longer side of the cable (or cables), if this will have the diameter (or these compose a strip) of not more than 5 cm, or on the contrary in the transverse direction (generally with more cables);
- after the laying of the bricks, it will be necessary to backfill the excavation until the maximum and transporting waste derived from the initial excavation.

The axis of the cable (or the middle one of more cables) must of course be in the same vertical plane with the axis of the row of bricks.

With regard to the depth of laying the cable (s) shall be placed sufficiently safe from possible excavation on the surface, for road or bumps repair or earthworks in areas with grass or garden.

The depth of at least 50 cm shall be guarantee in accordance with CEI 11-17

All the sand and the bricks needed will be provided by the Contractor 8the awarded company).

#### **Installation of insulated electrical cables, sheathed, in walkable tunnels**

The cables will be installed:

- Within existing grooves on piers in the tunnels (continuous support), purpose-made set up by the Contracting Authority;

- Within sheathing of suitable material, such as concrete, etc. (Equally continuous support) kept in place by small shelves in plate or galvanized steel profiles or reinforced concrete corbels;

- Directly on the hooks, clamps, brackets or corbels (discontinuous support) made of plate or galvanized steel profile or plastic materials resistant to moisture that is still on concrete corbels.

Having to arrange multilayer cables, a spacing between layer and layer shall be ensured, equal to at least one and a half times the diameter of the cable greater in the underlying layer with a minimum of 3 cm, in order to ensure the free circulation of air.

In this respect, the Contractor shall promptly indicate the characteristics for the sizing and shaping of any sheathing channels above, while, unless otherwise prescribed by the Contracting Authority, the Contractor shall meet all the requirements of shelves, brackets, clamps and hooks of each other, which will also form a convenient height racks.

For the sizing and the fixing (schnapps walled, fired nails etc.) the weight of the cables to be supported in relation to the spacing of the supports, shall be taken into account and shall be maximum around 70 cm.

In special cases, the Contracting Authority may request in advance that the steel parts shall be hot-dip galvanized.

The cables must be fitted with distinctive straps, stainless material, spaced at intervals of 150-200 m.

#### **Installation of insulated electrical cables, sheathed, in pipes, buried or not buried, or in anwalkable tunnels**

For the laying of the pipes to the wall or ceiling etc., in tunnels, cavities, underground etc. the above requirements, for laying cables in walkable tunnels, are valid with the necessary adaptations.

On the contrary, for the underground laying of pipes, the above requirements for the burying of electrical cables are valid, concerning the excavation, the preparation of the substrate (of course without the sand and without the row of bricks), the backfilling etc.

The pipes must be joined together with individual sections or tight collars or flanges, to avoid discontinuities in their inner surface.

The internal diameter of the pipe shall be in ratio of not less than 1.3 times the diameter of the cable or the circle circumscribing the cables, arranged in a wing.

For the cables insertion, adequate wells on burried piping and special boxes on non-buried piping are required.

The spacing between these wells and boxes will be determined in relation to the nature and size of the cables to be inserted. However, for cables under medium flow conditions and size, the spacing remains established maximum:

- each about 30 m if the straights;
- each about 15 m if a curve is inserted.

The cables cannot undergo bending radius less than 15 times their diameter.

At the time of tender, it will be specified if the Contracting Authority is in charge of the installation of wells or boxes. In this case, for their size, installation, connections etc., the Contractor shall supply all the necessary information.

### **Aerial installation of cables, insulated, non sheathed, or bare electrical conductors**

The aerial insulated, non sheathed, cables and bare electrical conductors shall comply with the IEC standards.

Unless otherwise specified within the contract, the supply of all materials and their implementation for aerial installation (support poles, brackets, insulators, cables, accessories etc.) shall be under Contractor's responsibility.

All transactions with third parties (power line easements, supportive, crossing institutions etc.), are only under the Contracting Authority jurisdiction, in accordance with the provisions within the Consolidated Laws on Water and on Electrical Installations, referred to RD 1775/1933 and subsequent amendments.

### **Aerial installation of electrical cables, insulated, sheathed, self-supporting or suspended carrier ropes**

Will be admitted to this laying system only cables intended to withstand operating voltages not exceeding 1000 V, in conformity insulated, except in cases of cables for power supply to lighting circuits in series or for supply to fluorescent tubes, with the upper limit of the allowable voltage is 6,000 volts.

With these restrictions of use will occur:

- self-supporting cables made of cross-linked polyethylene insulation for aerial wiring on alternating current, according to CEI 20-58;
- Cables with built-in support braided steel in the same insulating sheath;
- Cables suspended in independent braid galvanized (so-called "American" suspension steel) by means of buckles or hooks for suspension, suitably chosen among the commercial types, spaced not more than 40 cm.

For both cases, collars and shelves shall be used, suitably chosen among the commercial types, for the sealing of the cables on the supports, by means of the above-mentioned steel wire braids.

Even for aerial installation of electrical cables, insulated, sheathed, is integrally valid as provided in subparagraph *"Posa aerea di cavi elettrici, isolati, non sotto guaina, o di conduttori elettrici nudi"*. (Aerial Laying of electric cables, insulated, not sheathed, or of bare electrical conductors).

### **Protection against indirect contact**

All accessible metal parts of the electrical system and the equipment, not normally under voltage, but which, for the insulation detachment or other accidental causes, may be under voltage, shall be protected against indirect contact.

For protection against indirect contact, every electrical system or group of plants contained in the same building and its dependencies (such as separated gatehouses), shall have its own earthing system.

This earthing system shall be connected to all accessible metal piping systems for supply, distribution and discharge of water, as well as to all accessible metal masses of considerable extension in the existing electrical system.

### Earthing system and protective systems against indirect contacts

For each building containing electrical systems shall be properly planned, during its construction, its own earthing system (local ground facility) in accordance with the current standards CEI 64-8 / 1 to 7 and 64-12. The system shall be designed in order to carry out periodic efficiency test and includes:

a) the earth electrode, consisting of one or more metal plates into contact with the ground and which achieves the electrical connection with the earth (CEI 64-8 / 5);

b) the earth conductor, not in contact with the soil is intended to connect the electrodes with each other and to the earth main collector (or node). The partially buried conductors and not insulated from the ground shall be considered as sinks for the buried part and earth conductors for the portion not buried or otherwise insulated from the ground (standard CEI 64-8 / 5);

c) the protective conductor, part of the earth collector, will arrive in each system and shall be connected to all the plug sockets (for the supplying of devices for which provision is made for protection against indirect contact by earthing system) or directly in the masses of all the equipment to be protected, including the lighting fixtures with accessible metal parts. The use of protective conductors not mechanically protected with less than 4 mm<sup>2</sup> is forbidden. In TT systems (systems in which the masses are connected to an electrically independent earthing system from that of the ground connection of the electrical system), the neutral conductor cannot be used as a protective conductor;

d) the main ground collector (or node) connected to earth protective, equipotential bonding conductors. In the case of TN systems, the neutral conductor will also have the function of the protective conductor (CEI 64-8 / 5);

e) the equipotential bonding conductor, having the purpose of assuring the equipotential between the masses and / or the extraneous conductive parts, not forming part of the electrical system, which may introduce the ground potential (CEI 64-8 / 5).

### Art.08 – Heat accounting and management system, allocation and invoicing to users

The aim of the Contracting Authority is to obtain innovation and improvements for better performances in respect with the required performance ensured by the Project provided by the Contracting Authority, for the two buildings in Via F. Filzi and in Via dei Mulini, acting on the overall system and/or on one or more points, as listed below:

1. direct space temperature control (thermoregulation),
2. indoor daily and weekly set-point temperature management,
3. thermal energy consumption accounting for space heating in each housing unit,
4. smart metering data by operator,
5. estimated prospectus of the heat demand allocation for each housing, and distinction between voluntary and involuntary consumption, in accordance with D.Lgs 102/2014 and the connected standard UNI 10200:2015.
6. information management for actions and promotion of energy saving for each building unit and/or entire building.

In particular, the innovations are interesting and strategic for the Contracting Authority if allow improving the following required performances:

Performances
a. easy management of temperature control and daily and monthly timescale by users (user friendly systems);
b. more awareness of consumption and willingness to energy saving;
c. transparency, reliability, easy explanation to the users of consumption with accounting

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system, and conflict reduction;
d. opportunity to have periodic consumption report to promote the awareness and to realize intervention focused on energy saving;
e. direct and indirect cost reduction of the Contracting Authority for the smart metering data collection, for the consumption allocation and bills;
f. opportunity to easily integrate the heat management system with other control and regulation elements that can be installed in the future for a smart management;
g. system flexibility and adaptability over time, using also open and interoperable software in order to prevent a lock-in by users and client.

The Competitor have to include in the offer:

- I. System handbook/instructions, ease to comprehend by the occupants;
- II. Education/training for the occupants, for a better acceptance by users and a better performances exploitation of the technology.

The education/training activity shall be defined and set by the Contracting Authority and shall be carried out by specialized persons in communication with those kind of users (social actors , etc.)

The work description included in the current Chapter is supplementary and explicative of the Bill of Quantities, technical reports, and drawings, which are available to the competitors.

The competitor can in any case operate, with different design and technological solutions to improve and enlarge the performances in favour of users and accounting and invoicing service manager.

Clearly, the overall quality of the intervention and of its parts cannot be reduced, the quality is declared, implicit and explicit, by interventions description within this paragraph, and by Bill of Quantities, technical reports and drawings.

### **08.01 - In common criteria and recommendations for the system design**

- Supply and installation of four-way valve with built-in holder to be mounted on each heater with single-pipe circuit by-pass fixed, complete with flow sensor , to be mounted inside the heating body , attacks ½ " and thermostatic actuator. The thermostatic actuator must allow adjustment of the temperature in different rooms housing, preventing the tenants exceeding 23 ° C in the environment and the complete closure of the heating units as well. These functions can be carried out by acting both on the individual actuators and through centralized control and regulation systems "wireless" connected with the same actuators.
- Supply and installation of direct heat meter approved by UNI EN 1434, to be installed on the network detachment (return) of the ring heating circuit of each housing unit (single tube system), to locate in appropriate existing technical compartment with door and placed in the stairwell. The heat meter must be equipped with a wireless infrared operator. If dimensional problems require it, it is possible to provide for the replacement of the existing door with a metal cabinet of the same base and height, projecting not more than 20 cm from the wall, equipped with a lock suitable for a public place.
- The installation of heat meters includes emptying the circuit, the temporary separation of the pipes of the three circuits (made of insulated copper piping), cutting the existing iron branches, the reorganization of these branches with new ones made of the same isolated material and connected with welding, and subsequent insertion of the new shut-off ball valves and of the Y- filter on each return, in correspondence of the heat meters.
- Wi - fi standard reading devices according to the software provided by the manufacturer of allocators, with the possibility of an open interface to the system in order to download

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the consumption data and make the cost-allocation prospects.

Furthermore, the physical characteristics and overall performance of the intervention shall be ensured over time.

In any case, the system for thermoregulation and heat accounting, direct or indirect, shall comply with the provisions of Art. 9 - Measuring and billing of energy consumption - of DLGs 102/2015 "Implementation of Directive 2012/27 / EU on energy efficiency..."

Furthermore, for the first year of operation, the contractor shall proceed to make the consumption readings and return the thousandths table of the energy demands with the cost allocation, distinguished between voluntary and involuntary consumption as defined by the UNI 10200:2015.

### **08.02 – Heat accounting system in Via Fabio Filzi n. 11/13**

- Supply and installation, on each downstream of the collector detachment in the boiler manifold, of direct heat meter approved by UNI EN 1434, complete with electronic display probes (supplement of impulsive energy release) for the measured thermal energy display.

### **08.03 – Heat accounting system in Via Dei Mulini n. 10/20**

- Supply and installation of direct heat meter composed of direct volumetric meter, certified by UNI EN 1434, flanged for diameters greater than DN 50 mm and threaded for diameters less than DN 50 mm, complete with electronic display probes for the thermal energy display, measured in the primary circuit at upstream of the separator.
- Supply and installation, on each downstream of the collector detachment in the boiler manifold, of direct heat meter approved by UNI EN 1434, complete with electronic display probes (supplement of impulsive energy release) for the measured thermal energy display.

## **Art. 09 – Products/technologies guarantees**

The aim of the Contracting Authority is to achieve higher reliability of the overall interventions duration, seen as service life of used products and technologies, and their performance levels.

Since the awarding is based on objective and comparable criteria, as well as protective for the Contracting Authority, only guarantees provided by manufacturers and suppliers, with regard to technologies, products and materials, and guarantees issued by the companies, with insurance coverage to an insurance company recognized in at least one of the European states, are evaluated as reliability indicators.

- |                                  |           |
|----------------------------------|-----------|
| - Overall windows serviceability | ≥ 5 years |
| - Surface discolouring           | ≥ 6 years |
| - Double glazing condensation    | ≥ 5 years |
| - PVD treated handles corrosion  | ≥ 5 years |

Windows equipment serviceability

**The tender basic requirements is:**

<b>SUBJECTED TO GUARANTEES</b>	<b>YEARS</b>
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<b>1. ETICS for vertical opaque enclosure:</b>	
Materials with multiannual insurance policy.	<b>5</b>
Laying and installation defects, with insurance policy granted to the contractor.	<b>5</b>
<b>2. Insulating system for slab next to boxes, cellars and common areas at ground floor:</b>	
Materials with multiannual insurance policy.	<b>5</b>
Laying and installation defects, with insurance policy granted to the contractor.	<b>5</b>
<b>3. Windows / shading and solar radiation control systems:</b>	
Overall windows serviceability.	<b>5</b>
Surface discolouring.	<b>6</b>
Double glazing condensation.	<b>5</b>
PVD treated handles corrosion.	<b>5</b>
Windows, shading and solar radiation control system and equipment serviceability.	<b>3</b>
<b>4. Condensing boiler:</b>	
Heat exchanger.	<b>5</b>
Electronic components.	<b>2</b>
<b>5. Electronic circulation pumps:</b>	
Electronic components.	<b>2</b>
Mechanical and electromechanical parts.	<b>3</b>
<b>6. Valve and thermostatic head:</b>	
4-way valve.	<b>2</b>
Thermostatic head.	<b>2</b>
<b>7. Heat metering:</b>	
Electronic components.	<b>2</b>
Mechanical and electromechanical parts.	<b>2</b>

## **Art.10 – Ease of execution for ordinary maintenance and renovation**

The aim of the Contracting Authority is to achieve ordinary and extraordinary maintenance costs reduction promoting the use of products, components and technologies that, with the same overall performances, permit to carry out planned and/or extraordinary

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maintenance interventions in a simple, fast and inexpensive way.

**The tender basic requirement is:**

The minimum requirement corresponds to the use of products with performances in accordance with the regulations in force and the same minimum technical characteristics in respect with the ones used as reference in the Bill of Quantities and Price Analysis enclosed to this Special Conditions of Tender.

The clarification of the best features shall be supported by graphics or pictures and / or extracted from maintenance manuals supplied by manufacturers and anything else necessary to give the required credibility to those stated.

Bergamo, 15/02/2016

I Progettisti  
Arch. Monica Poloni

Ing. Massimo Ruotolo